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Michigan Termites or "White Ants"

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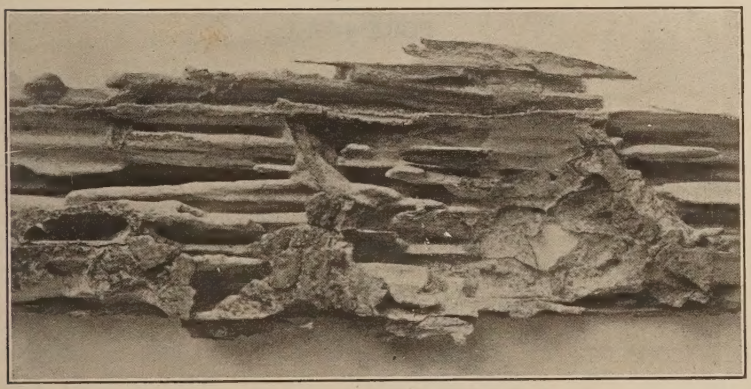

Work of Termites or "White Ants".

AGRICULTURAL EXPERIMENT STATION
MICHIGAN STATE COLLEGE
Of Agriculture and Applied Science

SECTION OF ENTOMOLOGY

East Lansing, Michigan

FOREWORD

The constantly increasing number of complaints sent to this office about termite activities has made it necessary to expand Circular Bulletin No. 134 to include new information for general use throughout the State. Complaints have been received from 50 or more localities in the Lower Peninsula during the last year. Not only are private dwellings attacked but public buildings as well, so this popular bulletin is written for those whose buildings are infested with these pests and for those who wish to avoid such attacks.

R. H. PETTIT.

MICHIGAN TERMITES or "WHITE ANTS"

E. I. McDANIEL

INTRODUCTION

There are 42* different species of termites known to occur in the United States. Of these, only two species have been recorded from Michigan. These two are the common species, *Reticulitermes flavipes,* a form that is becoming increasingly destructive throughout the lower two-thirds of the State, and *Reticulitermes arenincola,*† recently collected from sand dunes along Lake Michigan.

It is fortunate that termite work in Michigan is limited to the operations of one species, and that this one species belongs to the subterranean type which, in order to maintain itself continuously in a dwelling or other structure, must have contact with the moisture of the soil. This is, of course, in the absence of other sources of moisture, such as those supplied by leaky drains or by water of condensation from ice-boxes or, in fact, from moisture from any source whatever. In the absence of such vicarious moisture supply, it is only necessary to break the contact between the workings of the insect in wood, paper, or other dried vegetable matter and the soil and to supply a barrier over or through which termite highways may not be built. A well-lighted and airy space will serve as an efficient barrier, provided the construction of runways is prevented.

Put in this way, the task appears to be quite simple. However, the prevention of contacts on the outside surfaces of drains alone supplies us with a problem in itself. More complications arise in avoiding contacts between wood and the earth under concrete cellar floors. Wooden partitions and the storage of wooden furniture or even of firewood in the basement increase the possibilities of such contacts. Infestations have occurred through the cording of infested firewood against a wooden basement partition which supplied a contact that served as a highway and the entire building was invaded.

*1927. Snyder, Thomas E.—Termites Modify Building Codes. Jr. Ec. Entomology, Volume 20, pp. 316-321.

†1931. Goellner, Eugene J.—A New Species of Termites, *Reticulitermes arenincola,* from the Sand Dunes of Indiana and Michigan along the Shores of Lake Michigan. Proc. Ent. Soc. of Washington, Vol. 33, No. 9, p. 227.

SUGGESTIONS FOR THE CONSTRUCTION OF TERMITE-PROOF STRUCTURES

The construction of a termite-proof building implies the use of expedients which will render it impossible for termites to gain entrance from outside into the woodwork of the building. Keeping in mind the necessity of contact with the soil or with other sources of moisture, it would appear that the use of barriers of good quality cement in the

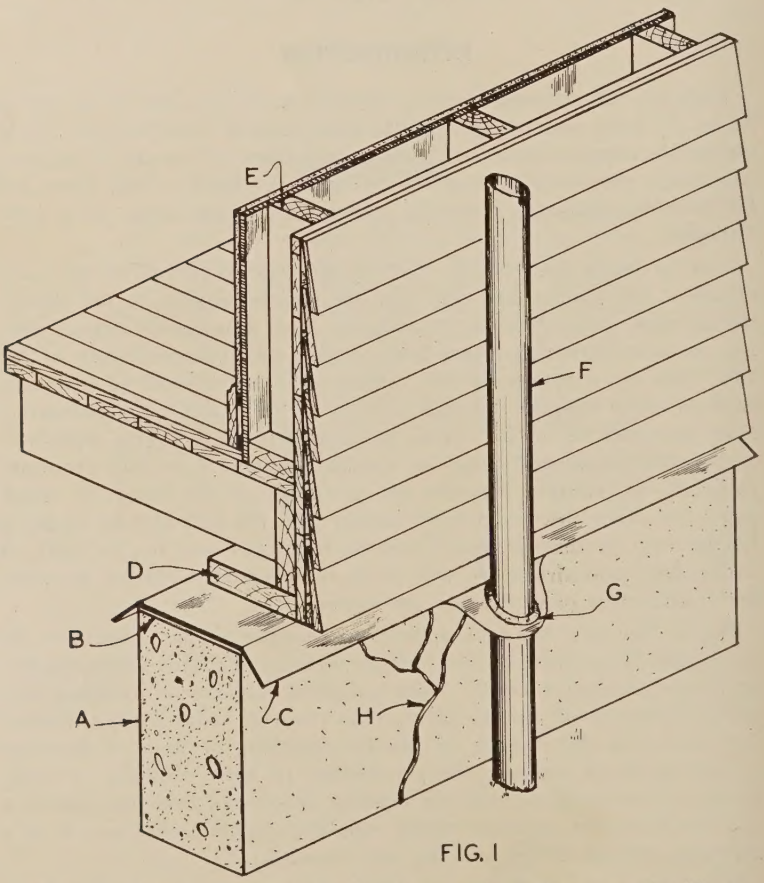

Fig. 1. Flashing of foundation wall with corrosion-resistant metal with protected drain pipe in place. a, foundation wall; b, layer of dense concrete sealing foundation wall; c, flashing of corrosion-resistant metal plate; d, sill; e, stud; f, pipe; g, protecting flange which must be fitted to the pipe and to the flashing; h, covered passageway built by termites but checked by flashing.

form of cappings, together with the installation of flashings of corrosion-resistant metal sheets to forestall the building of covered passageways at all points where such contacts might be made, would accomplish this purpose.

Such a building would be constructed with the following points in mind:

1. Clear the ground beneath the proposed building of all shavings, blocks, wooden grading stakes, and all refuse and debris of any kind, before starting to lay any concrete. At this time, if termites are found to be present in the soil or in decaying stumps, they should be removed by thoroughly drenching the soil with carbon disulphide emulsion or some other killing agent, see page 10.

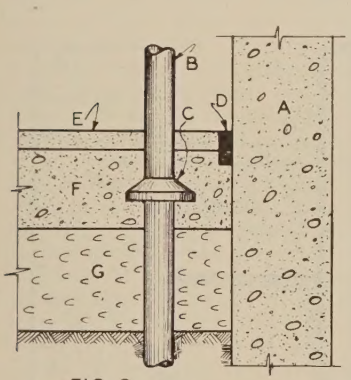

FIG. 2

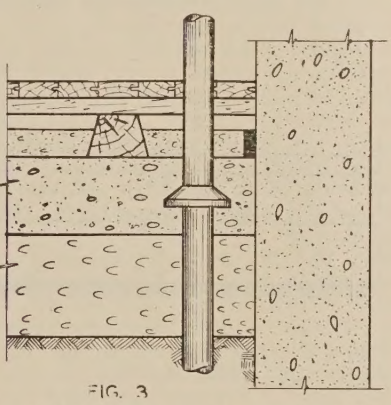

FIG. 3

Fig. 2. Ordinary type of construction, in which the floor is sealed to the foundation wall by means of a channel containing an asphalt mastic expansion joint, showing the proper way to break the possible ascent of termites by a metal flange around the pipe. a, foundation wall; b, pipe; c, flange of corrosion-resistant metal; d, asphalt mastic expansion joint; e, high grade cement; f, ordinary concrete; g, gravel and concrete.

Fig. 3. Represents a less usual type of construction, somewhat similar to that shown in Fig. 2, with the exception that the proper way to lay a wooden floor over concrete is shown.

2. Lay masonry foundations and footings in Portland cement mortar. Make all basement floors of dense, high-grade concrete and use construction that will not crack.
3. Eliminate all untreated wood from foundation, basement, porches, or steps and substitute either steel, cement, or treated wood, as the case may require. Wherever it is necessary for a wooden column to rest on a basement concrete floor, reinforce the floor with special footings of sufficient width and depth to prevent settling. Where it is desirable that a flight of wooden steps be used, starting from the ground they should rest on a concrete platform high enough to form the first step.

4. Cap all foundation walls, whether of solid masonry or of hollow tile, with a termite-proof metal shield. This shield may consist of a continuous plate of corrosion-resistant metal with a projecting edge, resting on a layer of Portland cement mortar one inch thick and which should be from 18 inches to two feet above the ground level. The above-mentioned corrosion-resistant metal shield consists of a continuous strip of copper or other corrosion-resistant metal of heavy gauge laid flat in one inch of Portland cement mortar on the top of the foundation wall, so that it projects both inside and outside the wall for two inches in the open. It is bent downward at an angle of about 45 degrees all the way round, and serves to prevent the construction of covered passageways by the insects, passageways that might connect the wooden sill which rests thereon with the soil.

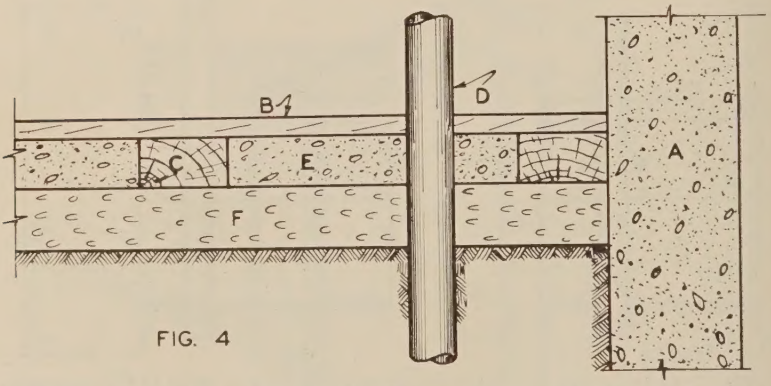

Fig. 4. Dangerous type of construction. Pipe unprotected; union between floor and foundation wall not sealed; sleepers exposed to possible termite infestation from the ground through the coarse gravel. a, foundation wall; b, floor; c, untreated sleeper; d, pipe; e, dense concrete; f, coarse gravel or cinders.

5. Arrange for an air-space of from 18 to 24 inches under buildings which do not have basements and provide adequate screened openings in the foundation wall to provide for ventilation and to supply light.
6. Thoroughly impregnate with coal-tar creosote all timbers that are to come in contact or near contact with the ground, all sleepers and joists that are to be imbedded in masonry or that are to be laid on concrete which is in contact with the ground. Treat the timbers by means of the standard pressure method in a closed chamber. When it is necessary to cut treated timbers, see that the freshly-cut surfaces are treated with coal-tar creosote.
7. Tiles, drain-pipes, and sewers should be cemented tightly into the foundation wall, using a cement that will not crack and that will be permanent. Iron pipes supplying gas, water, or those

which contain electric wires must likewise be tightly cemented. On a level with the flashing of the foundation, each pipe should carry a flange of corrosion-resistant metal tightly fitted in place. This is to serve as a barrier against the building of covered passageways by the termites.

8. Fill expansion joints between concrete floor and wall with asphalt mastic.

HOW TERMITES GET INTO BUILDINGS

In many parts of the State, the roots of trees, stumps, and fallen logs are buried in the soil and serve as ideal breeding-places for termites. Where untreated wooden fence posts are set in such infested soil, they are soon attacked. In the vineyards of the State, many untreated wooden posts are still used. Where corn is planted on infested land, the growing plants may be attacked. The infested corn, if brought into barns or into the vicinity of farm buildings, allows the termites to become established, later to move into the buildings themselves. Termites often establish themselves in abandoned frame buildings or in bits of buried wood. Usually, this wood is dead. All such pieces of wooden refuse and debris are likely to be converted into termite nests and the pests spread from them to useful structures. They may either spread directly through exploratory tunnels in the soil and thus gain entrance or they may be carried in with infested firewood. Wherever untreated wood comes in contact with the soil, it is subject to this hazard. Furthermore, products of wood pulp, such as paper made from wood pulp, or even from rags, are likewise sources of danger if a path exists by means of which contact with the soil is possible. Once established in the timbers of a dwelling, termites may continue to breed and feed in obscurity over a period of years, constantly opening up new hollows in the wood and working with such secrecy that they remain undetected. In contrast to the work of powder-post beetles, the nests of termites are not filled with wood flour, but they contain waste matter, which dries out and which has the power to absorb liquids freely. It will readily absorb kerosene, kerosene and creosote, and other combinations of killing agents, just as blotting paper takes up ink. The killing agents will give off vapor, which will penetrate still further into the workings of the pests if the fumes are kept confined. Hence, it is advised that, rather than to tear down structures and to try to chase out each individual insect, that small holes be drilled into the cavities and that some killing agent be injected into the cavity from which it will spread by evaporation and finally reach the uttermost ends of the cavities.

Termites are said to abhor light. This is, in a manner, true. They dislike to come out into the open, and in order to avoid doing so they will build covered passageways of cemented bits of wood from one feeding place to another, probably working at night in the construction of these covered tunnels. Sometimes, covered passageways will be constructed from the nests in the soil upward over foundation walls to the wooden sill of a building by means of which contact is made

between the earth and the food supply. Sometimes large numbers of these termite tunnels extend between the soil and the untreated wood of which the building is constructed. Under such conditions, the work goes on apace, and the destruction of the building sometimes takes place rapidly.

Termites live in colonies, somewhat similar to those of bees, and in large colonies there comes a time in June out-of-doors, but often in March in heated buildings, when winged swarms appear. These winged forms fly for a short distance and attack unpainted surfaces of wood. They may even make their entrances through an unputtied nail-hole. The swarm usually comes out in a basement through some opening in the floor or other woodwork, and at such times hundreds or perhaps thousands of winged individuals take flight and for an hour or so they lose their distaste for light in the search for suitable places to start fresh colonies. After such places are found the insects break off their wings, which are scored across near their bases, and each pair digs in industriously. They are relatively conspicuous at such times, and, to the initiated, the finding of the wings where they have drifted to the floor can have but one meaning. This discovery should be followed by the immediate search for hollowed-out places in the woodwork and by the application of drastic control measures. Sometimes, on tearing out a bit of timber, their workings will be exposed. Sometimes, a thin place in the floor will break through and the termites will be revealed. Sometimes, a little searching will bring them to light. At any rate, the finding of broken-off wings should be regarded with suspicion, and an immediate search should be made.

Where untreated timbers come in contact with infested soil is always a point of danger. The use of infested compost in the soil of greenhouses or cold frames is, of course, a dangerous practice. Likewise, the use of infested soil for the repotting of house plants is a practice to be avoided.

Termites are particularly fond of barnyard manure. Therefore, in regions where termites abound, avoid its use as a top-dressing on lawns, but rather depend on commercial fertilizers.

HOW TERMITES INJURE BUILDINGS

Termite injuries range, in Michigan, from the destruction of dog kennels to the impairment of dwellings which cost up to one hundred thousand dollars, and the insects damage public buildings valued at hundreds of thousands of dollars. They work under cover, and may remove the interior of a timber almost completely, leaving barely enough wood intact to maintain its original form. Wainscoting may be so hollowed out from behind that only a paper-like shell remains in place to support the paint or varnish, and yet it will appear to the casual observer to be in good condition. On opening up such a hollowed-out shell of timber, one sees that the harder parts of the wood are left in place, so that though one may easily poke a finger through the surface of the shell at one point, the wood will remain so braced and buttressed inside as still to maintain its original outward appear-

ance. Often, floor-boards are so thinned from beneath that they give way under the pressure of the foot. Sometimes, it take many years to reach this condition, especially if hardwood is used. At other times, the work is quickly done and certain portions of a building will arrive at a condition of collapse before discovery. The lower floors suffer first, because they are nearest to the soil, although the injury is not restricted to the lower parts of a building.

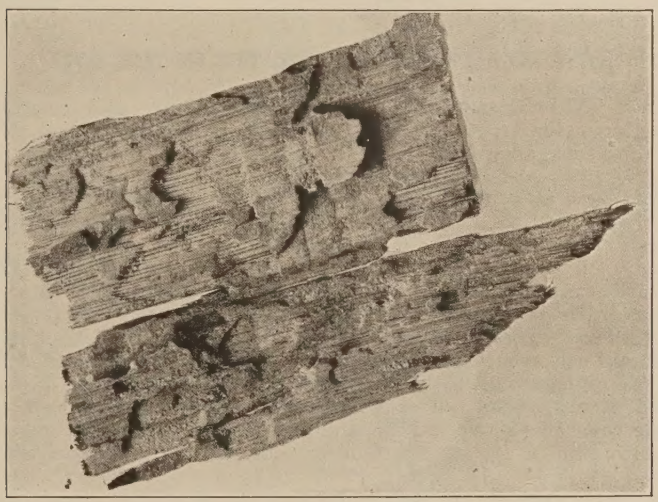

Fig. 5. Work of termites in timber, reduced.

HOW TO GET TERMITES OUT OF A HOUSE

On first discovering that a building is infested, it is well to pause and take stock. Go over the walls and wainscoting and all accessible parts with a hammer and a piece of chalk, in order that the spaces that have been hollowed out may be located and marked. The next step is to drill into the hollowed-out cavities with a clean-cutting quarter-inch, or perhaps one-eighth inch, drill and to inject some volatile killing-agent, like kerosene, into all the cavities. Kerosene is mentioned first because it is cheap, volatile, and can be obtained almost anywhere. The addition of pyrethrum dust to kerosene improves it greatly, the proportion should be one-half pound of the ground flowers of pyrethrum to one gallon of kerosene. Various other killing agents may be substituted for the pyrethrum. The most effective of these is coal-tar creosote, the fumes of which will fill the cavity and spread throughout the workings of the pests and kill them.

After every termite highway has been destroyed or rendered ineffective, and after each covered passageway has been crushed and treated with kerosene and coal-tar creosote or some similar preparation, replace impaired timbers with sound, treated timbers and do away with all sources of moisture from leaks. Follow this by a period of watchfulness, during which isolated pockets may be discovered and treated. Build in all replacements with termite prevention in mind and err on the side of taking too many precautions rather than through omissions.

HOW TO ERADICATE TERMITES IN THE SOIL

Where soil is infested with termites, first remove and burn all decaying logs, stumps, fence posts, and wooden sidewalks. Treat all outbuildings, such as woodsheds, dog kennels, and chicken houses, with kerosene and coal-tar creosote or with some similar preparation. Collect and burn all prunings, remove all dead trees, protect living tissue with shellac, and paint dead wood on recent wounds with a mixture of one part creosote and three parts kerosene.

Sandy soil rich in organic matter is attractive to termites. Where barnyard manure is used as a fertilizer or where the soil is filled with an abundance of decaying vegetation, such as rotting wood or corn stubble, termite nests may be distributed over acres of ground. Infested soil can eventually be cleared of termites by continual cultivation. Termites do not become established in fields when the ground is plowed deeply in the fall or where crop rotation is practiced. Corn stubble should be removed from the ground and burned instead of being plowed under for termite food in districts where termites abound.

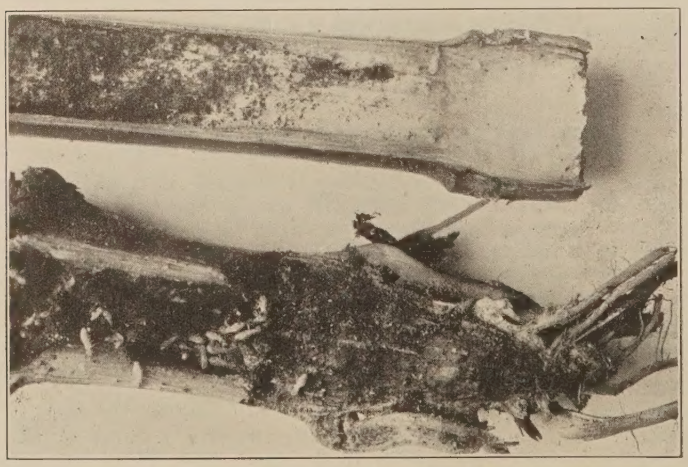

Fig. 6. Living cornstalks tunneled by common termite.

After the soil is plowed deeply, it may or may not be necessary to treat with chemicals. Effective soil treating chemicals are:

a. Sodium cyanide (160 pounds dissolved in 12,000 gallons of water per acre).

b. Carbon disulphide emulsion.

The effectiveness of the dilution of the standard 50 per cent emulsion depends upon the temperature of the soil. The 50 per cent emulsion should be diluted as follows:

40°-50° F. ..... 68 cc. emulsion to 10 gallons of water
50°-60° F. ..... 57 cc. emulsion to 10 gallons of water
60°-70° F. ..... 45 cc. emulsion to 10 gallons of water

Pour the carbon disulphide emulsion into water and agitate. Use 2½ gallons of the diluted emulsion to a square foot.

c. Kerosene. To be used in places where there is no vegetation to be considered.

d. Kerosene and coal-tar creosote, three parts of the former to one of the latter. The coal-tar creosote fortifies the kerosene and makes it more effective. This mixture can be used only where there is no vegetation.

e. Kerosene and pyrethrum. Add one-half pound of pyrethrum powder, flora grade, to each gallon of kerosene and let this stand for 48 hours before applying. This mixture is likewise to be used in the absence of vegetation.

f. A 10 per cent solution of sodium arsenite also may be used in the absence of vegetation. Sodium arsenite is a violent poison, both to plants and animals. It will, however, leach out of the soil in the course of a few years.

Where termites attack living trees, cultivate the soil thoroughly and use commercial fertilizer in place of barnyard manure. The use of carbon disulphide emulsion about the bases of the trees in the early spring while the tree is still dormant will kill many termites.

TREATMENT OF TIMBERS

It has been found that wood treated with zinc-chloride, with bichloride of mercury, or with a 10 per cent solution of sodium arsenite is for a time practically termite-proof. Wood so treated takes paint, and where the surface of such wood is painted the poison is retained longer. Wood impregnated with poison is particularly useful in greenhouse construction, in hot-beds, or cold-frames, since wood treated with coal-tar creosote is not safe to use in the immediate vicinity of growing plants. Wood so treated also has its place in interior construction, where a finish is required.

COAL-TAR CREOSOTE

The American Wood-Preservers Association specify that the coal-tar creosote treatment takes place under pressure in a closed container to secure proper penetration of the wood. Where lumber is dipped in boiling vats of coal-tar creosote and allowed to boil for several hours leaving the wood in the vats until the liquid cools, some protection will be secured, although nothing in comparison to that attained where the treatment takes place under pressure. The application of coal-tar creosote with a paint brush is of little value.

SODIUM ARSENITE

In order to termite-proof timbers, they must be soaked for 24 hours in a 10 per cent solution of sodium arsenite: dilute one gallon of the commercial 40 per cent solution with four gallons of water.

CORROSION-RESISTANT METAL PLATES

Of the numerous corrosion-resistant metal plates suggested for use as barriers against termite-travel, the following have given the best satisfaction. Hard copper plate .04 inch thick is to be preferred. Soft copper will be effective where hard copper cannot be obtained. Brass is suitable if it is an alloy of from 80 to 85 per cent copper and the remainder zinc. It is also suggested that plates of stainless steel would be permanent and would probably be less expensive than copper, although at present there is no record here of their use for this purpose.

LIFE HISTORY

The slightly reniform, or kidney-shaped eggs, about one-twenty-fifth of an inch in length, are usually found in clusters or scattered singly in the galleries. These hatch into young of both sexes which may develop into one of several castes, including workers, soldiers, and true winged males or females. Both the soldiers and the workers are provided with sexual apparatus which remains undeveloped. Beside these, sometimes, wingless supplemental males and females develop which are capable of producing eggs that probably hatch later into workers and soldiers.

It is not necessary that individuals of both egg-laying forms be present in the colony at one time. The colony is headed by a true queen, in most instances by a queen which originally was provided with wings and which, after mating, in company with a male started the colony. It is her business to lay eggs and, after the colony is once built up, to do nothing else for several years. It is this form, together with the

Fig. 7. Winged form of common termite, enlarged.

accompanying males, that supply the individuals of which a swarm is made up. Unlike bees, there are sometimes several royal pairs hidden away in a single colony, so well-hidden, in fact, that they are seldom seem.

Both sexes are represented among the workers. The individuals are small, soft-bodied creatures. They are blind and the mouthparts are supplied with mandibles fitted for both tearing and rasping. Workers require about six months to develop. On them, falls the labor of maintaining the colony, surpassing as they do all other castes in numbers, and it falls to their lot to extend the galleries, to build the covered passageways, and to care for the queen. They are the pawns of the colony.

Last of all come the soldiers, distinguished by their large elongated heads. The prime reason for their existence is to do whatever fighting is required. They possess large heads and a pair of jaws by no means to be ignored. One sees a few soldiers scattered among a horde of workers when the galleries of a colony are disturbed.

Fig. 8. Workers and soldiers of common termite, enlarged.

The writer desires to thank Professor H. H. Musselman, Head of the Department of Agricultural Engineering, for valuable assistance, both in supplying suggestions during the progress of the work, as well as for the drawing of Figures 1, 2, 3, and 4. His knowledge of current architectural practice has made it possible to prescribe workable building plans. The writer wishes also to thank Dr. R. H. Pettit for his aid and encouragement in the preparation of this bulletin.

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